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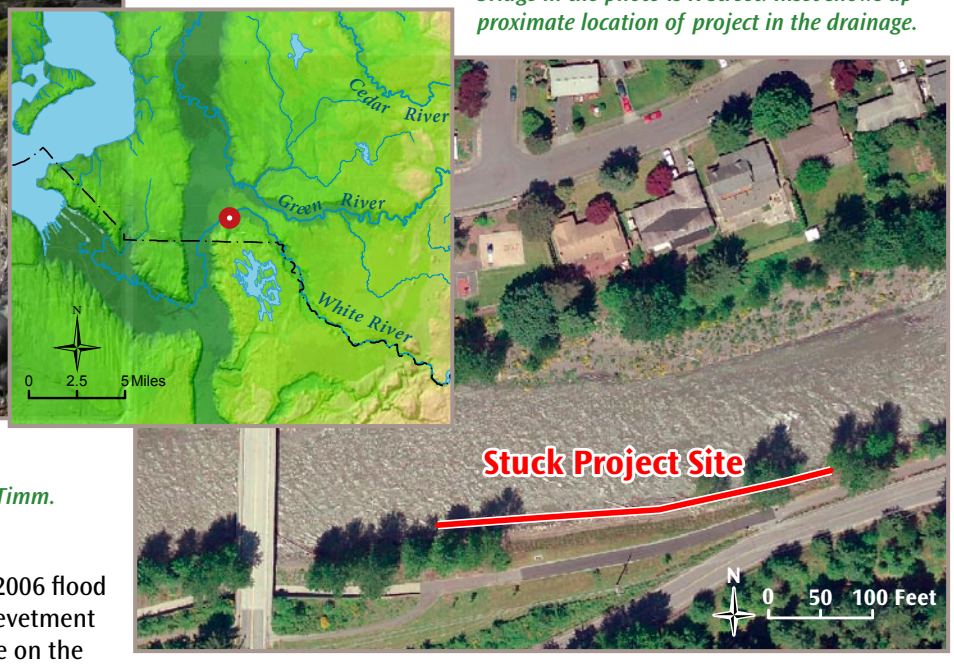
2009 Year 1 Post-Construction Monitoring of the Stuck River Drive Revetment Repair, White River

By Ray Timm and Sarah McCarthy

Photo 1. An eroded portion of the Stuck River revetment taken from the White River looking upstream just above the R Street Bridge. Photo: Ray Timm.



Map 1 & Photo 2. Regional/Vicinity map with approximate location of Stuck River Revetment Repair Project, topographic bed survey (light blue line), 7.5 miles above the confluence with the Puyallup River. Note, the bridge in the photo is R Street. Inset shows approximate location of project in the drainage.

A facility inspection following the November 2006 flood revealed damage to the Stuck River Drive Revetment which is located upstream of the R Street Bridge on the White River in Auburn, Washington. The revetment is a flood protection facility made primarily of rock riprap designed to protect the river bank from erosion. The revetment was severely eroded and undercut, requiring repair (Photo 1). The revetment repair, which was completed in 2008, was intended to protect nearby infrastructure while improving aquatic habitat diversity and cover in this segment of the White River.

Project Site

The project site is on the left bank of the White River in the City of Auburn. The site is within a broad floodplain area about 7.5 miles upstream of the White River's confluence with the Puyallup River (Map 1, Photo 2). The left bank in this location is hardened continuously for about 2.5 miles upstream from the project site, and flow velocities along the left bank and throughout this reach can be high for fish during flood events. Because the site is in a reach that is largely confined by flood protection facilities, there is very little low velocity habitat or refuge for juvenile fish. The White River also carries a high sediment load.

The White River and its tributaries serve as essential spawning, rearing and migration habitat for chinook, pink, chum, sockeye and coho salmon, as well as winter and summer steelhead, resident rainbow, bull, and cutthroat trout. Currently, chinook, steelhead, and bull trout are listed as threatened under the Endangered Species Act. King County's flood facility repairs strive to improve habitat conditions for salmon by increasing habitat complexity and vegetation along the river bank.

Monitoring Methods

Monitoring of the repair site is intended to document progress toward meeting the following project objectives:

1. Repair the revetment and lay back (flatten) bank slopes where possible.
2. Improve habitat complexity along the facility (sedimentation and scour pools).

3. Improve the quality of the river bank by increasing the amount of native vegetation on the bank and hanging over the channel.

Monitoring activities include photographic documentation of the site, bed material characterization, and assessment of plant survival. Post-construction monitoring was initiated in 2009 (Year 1), and included photography, measurements of bed elevation along the facility, and observations of bed material characteristics. In addition, a post-flood facility damage assessment was conducted immediately following a large flood event in January 2009. During this flood event, the river flow exceeded 12,000 cubic feet per second and corresponded to slightly less than a 10-year discharge event. Vegetation survival (and any necessary plant maintenance) will be conducted in years 3 and 5.

Photo 3. Stuck River Revetment Repair site during 12,200 cfs event, Jan. 9, 2009. Notice the difference in water velocities between the large wood and the bank, and channelward of the wood. Photo: Terry Butler.

Year 1 Results

The introduction of large roughness elements along the bank was expected to create local scour and sediment deposition around placed boulders and large wood. Instead, it appears that because the large wood and boulders were all placed in a relatively continuous configuration, the water velocity was decreased along the entire facility, causing sediment deposition but no scour near the toe of the facility (Figure 1). Formal sediment particle size measurements were not conducted, but from visual inspection, the mean particle size appeared to be much finer than that observed prior to construction. In fact, much of the placed rock was buried under sand along the margin of the bank following the January 2009 flood.

The bank was indeed protected from damage during the January 2009 flood. Post-flood inspections revealed an intact facility with no signs of erosion. In addition, visual inspections close to the peak of the storm discovered slower-moving water around the large wood and boulders, contrasted by swift-moving water in the center of the channel (photo 3). A small amount of flood-borne wood floating downstream was recruited to the revetment repair, but did not cause any damage to the facility or anchored large wood.

The monitoring revealed two main results:

- First, the revetment was successfully repaired and the bank was protected from damage during the 2009 high flow event that was comparable to the 2006 flow discharge that caused the flood damage to the facility. Therefore, the first project objective was met.
- Second, it appears that slower water velocities and/or high sediment loads in the White River caused sedimentation along the toe of the facility. Habitat complexity was increased initially through the placement of large wood and boulders, but may have been slightly reduced by the sediment deposition.

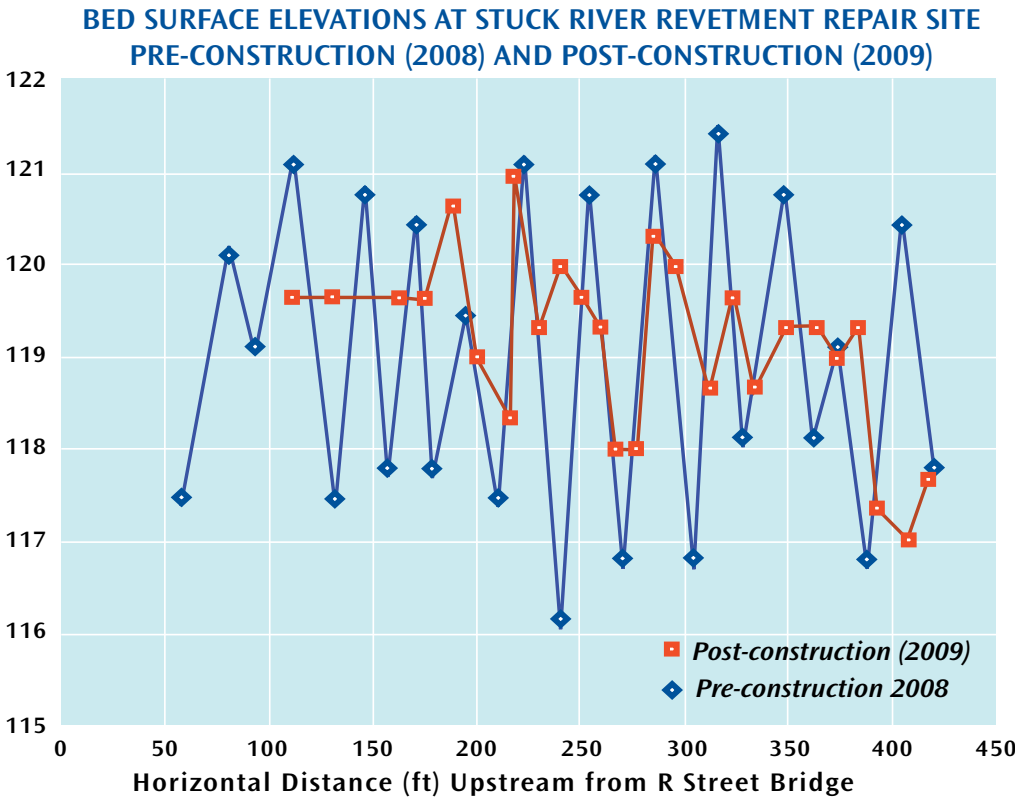


Figure 1.

Conclusion and Next Steps

These findings show the utility of installing large roughness elements in the river channel as velocity-dampening bank protection. Bed characteristics along facilities may have the potential to change quickly due to the high sediment load in the White River.

The large wood and boulders installed at the toe of the facility were intended to provide rearing habitat and low velocity flood refuge for fish. Visual surveys when juvenile fish are likely to be present and velocity measurements during a high flow event would be useful for documenting project effectiveness. As the installed vegetation matures, we expect the overhanging cover to further benefit fish by providing shade and invertebrate prey sources. Continued monitoring is recommended to determine the long-term effectiveness of the project in terms of flood protection, habitat function, and cost effectiveness.

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